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GAMBLING SUPERSTITIONS.

By Richard A. Proctor.

(*Continued from page* 51.)

WHY is it, then, it will be asked, that the inexorable law of averages is yet not to be trusted? For this reason, simply, that the mode of its operation is altogether uncertain. If in a thousand trials there has been a remarkable preponderance of any particular class of events, it is not a whit more probable that the preponderance will be compensated by a corresponding deficiency in the next thousand trials than that it will be repeated in that set also. The most probable result of the second thousand trials is precisely that result which was most probable for the first thousand—that is, that there will be no marked preponderance either way. But there *may be* such a preponderance; and it may lie either way. It is the same with the next thousand, and the next, and for every such set. They are in no way affected by preceding events. In the nature of things, how can they be? But, "the whirligig of time brings in its revenges" in its own way. The balance is restored just as chance directs. It may be in the next thousand trials, it may be not before many thousands of trials. We are utterly unable to guess when or how it will be brought about.

But it may be urged that this is mere assertion; and many will be very ready to believe that it is opposed to experience, or even contrary to common sense. Yet experience has over and over again confirmed the matter, and common sense, though it may not avail to unravel the seeming paradox, yet cannot insist on the absurdity that coming events of pure chance are affected by completed events of the same kind. If a person has tossed "heads" nine times running (we assume fair and lofty tosses with a well-balanced coin), common sense teaches him, as he is about to make the tenth trial, that the chances on that trial are precisely the same as the chances on the first. It would, indeed, have been rash far him to predict that he would reach that trial without once failing to toss "head;" but as the thing has happened, the odds originally against it count for nothing. They are disposed of by known facts. I have said, however, that experience confirms our theory. It chances that a series of experiments have been made on coin-tossing. Buffon was the experimenter, and he tossed thousands of times, noting always how many times he tossed "head" running before "tail" appeared. In the course of these trials he many times tossed "head" nine times running. Now, if the tossing "head" nine times running rendered the chance of tossing a tenth head much less than usual, it would necessarily follow that in considerably more than one-half of these instances Buffon would have failed to toss a tenth "head." But he did not. I shall give hereafter the exact numbers. Here, I note only that in about half the cases in which he tossed nine "heads" running, the next trial also gave him "head;" and about half of these tossing of ten successive "heads" were followed by the tossing of an eleventh "head." In the nature of things this was to be expected.

And now let us consider the cognate questions suggested by our sharper's ideas respecting the person who plays. This person is to consider carefully whether he is "*in vein*," and not otherwise to play. He is to be cool and businesslike, for fortune is invariably adverse to an angry player. Steinmetz, who appears to place some degree of reliance on the suggestion that a player should be "in vein," cites in illustration and confirmation of the rule the following instance from his own experience:—"I remember," he says, "a curious incident in my childhood which seems very much to the point of this axiom. A magnificent gold watch and chain were given towards the building of a church, and my mother took three chances, which were at a very high figure, the watch and chain being valued at more than £100. One of these chances was entered in my name, one in my brother's, and a third in my mother's. I had to throw for her as well as myself. My brother threw an insignificant figure; for myself I did the same; but, oddly enough, I refused to throw for my mother on finding that I had lost my chance, saying that I should wait a little longer—rather a curious piece of prudence" (read, rather, superstition) "for a child of thirteen. The raffle was with three dice; the majority of the chances had been thrown, and thirty-four was the highest." (It is to be presumed that the three dice were thrown twice, yet "thirty-four" is a remarkable throw with six dice, and "thirty-six" altogether exceptional.) "I went on throwing the dice for amusement, and was surprised to find that every throw was better than the one I had in the raffle. I thereupon said, 'Now I'll throw for mamma.' I threw thirty-six, which won the watch! My mother had been a large subscriber to the building of the church, and the priest said that my winning the watch for her was quite *providential*. According to M. Houdin's authority, however, it seems that I only got into 'vein,'—but how I came to pause and defer throwing the last chance has always puzzled me respecting this incident of childhood, which made too great an impression ever to be effaced."

It is probable that most of our readers can recall some circumstance in their lives, some surprising coincidence, which has caused a similar impression, and which they have found it almost impossible to regard as strictly fortuitous.

In chance games especially, curious coincidences of the sort occur, and lead to the superstitious notion that they are not mere coincidences, but in some definite way associated with the fate or fortune of the player, or else with some event which has previously taken place,—a change of seats, a new deal, or the like. There is scarcely a gambler who is not prepared to assert his faith in certain observances whereby, as he believes, a change of luck may be

brought about. In an old work on card-games the player is gravely advised, if the luck has been against him, to turn three times round with his chair, "for then the luck will infallibly change in your favour."

Equally superstitious is the notion that anger brings bad luck, or, as M. Houdin's authority puts it, that "the demon of bad luck invariably pursues a passionate player." At a game of pure chance good temper makes the player careless under ill-fortune, but it cannot secure him against it. In like manner, passion may excite the attention of others to the player's losses, and in any case causes himself to suffer more keenly under them, but it is only in this sense that passion is unlucky for him. He is as likely to make a lucky hit when in a rage as in the calmest mood.

It is easy to see how superstitions such as these take their origin. We can understand that since one who has been very unlucky in games of pure chance, is not antecedently likely to continue equally unlucky, a superstitious observance is not unlikely to be followed by a seeming change of luck. When this happens the coincidence is noted and remembered; but failures are readily forgotten. Again, if the fortunes of a passionate player be recorded by dispassionate bystanders, he will not appear to be pursued by worse luck than his neighbours; but he will be disposed to regard himself as the victim of unusual ill-fortune. He may perhaps register a vow to keep his temper in future; and then his luck may seem to him to improve, even though a careful record of his gains and losses would show no change whatever in his fortunes.

(To be continued.)

OUR EARTH'S DUST ENVELOPE.*

By Prof. S. P. Langley.

At first I supposed the sunset matter a local phenomenon, but when the reports showed it to have been visible all over the world, it was obvious that we must look for some equally general cause. We know but two likely ones, and these have been already brought forward. One is the advent of an unusual amount of meteoric dust. While something over ten millions of meteorites are known to enter our atmosphere daily, which are dissipated in dust and vapour in the upper atmosphere, the total mass of these is small as compared with the bulk of the atmosphere itself, although absolutely large. It is difficult to state with precision what this amount is. But several lines of evidence lead us to think it is approximately not greatly less than 100 tons per diem, nor greatly more than 1,000 tons per diem. Taking the largest estimate as still below the truth, we must suppose an enormously greater accession than this to supply quantity sufficient to produce the phenomenon in question; and it is hardly possible to imagine such a meteoric inflow unaccompanied with visual phenomena in the form of "shooting stars," which would make its advent visible to all. Admitting, then, the possibility of meteoric influence, we must consider it to be nevertheless extremely improbable.

There is another cause which seems to me more acceptable—that of volcanic dust; and in relation to this presence of dust in the entire atmosphere of the planet, I can offer some little personal experience. In 1878 I was on the upper slopes of Mount Etna, in the volcanic wastes, three or four hours' journey above the zone of fertile ground. I passed a portion of the winter at that elevation engaged in studying the transparency of the earth's atmosphere. I was much impressed by the fact that here, on a site where the air is supposed to be as clear as anywhere in the world, at this considerable altitude, and where we were surrounded by snow-fields and deserts of black lava, the telescope showed that the air was filled with minute dust particles, which evidently had no relation to the local surroundings, but apparently formed a portion of an envelope common to the whole earth. I was confirmed in this opinion by my recollection that Prof. Piazzi Smyth, on the Peak of Teneriffe, in mid-ocean, saw these strata of dust rising to the height of over a mile, reaching out to the horizon in every direction, and so dense that they frequently hid a neighbouring island mountain, whose peak rose above them, as though out of an upper sea. In 1881 I was on Mount Whitney, in Southern California, the highest peak in the United States, unless some of the Alaskan mountains can rival it. I had gone there with an expedition from the Alleghany Observatory, under the official direction of General Hazen, of the Signal Service, and had camped at an altitude of 12,000 ft., with a special object of studying analogous phenomena. On ascending the peak of Whitney, from an altitude of nearly 15,000 ft., the eye looks to the east over one of the most barren regions in the world. Immediately at the foot of the mountain is the Inyo desert, and on the east a range of mountains parallel to the Sierra Nevadas, but only about 10,000 ft. in height. From the valley the atmosphere had appeared beautifully clear. Bnt from this aërial height we looked down on what seemed a kind of level dust-ocean, invisible from below, but whose depth was 6,000 ft. or 7,000 ft., as the upper portion only of the opposite mountain range rose clearly out of it. The colour of the light reflected to us from this dust-ocean was clearly red, and it stretched as far as the eye could reach in every direction, although there was no special wind or local cause for it. It was evidently like the dust seen in mid-ocean from the Peak of Teneriffe—something present all the time, and a permanent ingredient in the earth's atmosphere.

At our own great elevation the sky was of a remarkably deep violet, and it seemed at first as if no dust was present in this upper air, but in getting, just at noon, in the edge of the shadow of a range of cliffs, which rose 1,200 feet above us, the sky immediately about the sun took on a whitish hue. On scrutinising this through the telescope it was found to be due to myriads of the minutest dust particles. I was here at a far greater height than the summit of Etna, with nothing around me except granite and snow-fields, and the presence of this dust in a comparatively calm air much impressed me. I mentioned it to Mr. Clarence King, then Director of the United States Geological Surveys, who was one of the first to ascend Mount Whitney, and he informed me that this upper dust was probably due to the "loess" of China, having been borne across the Pacific and a quarter of the way around the world. We were at the summit of the continent, and the air which swept by us was unmingled with that of the lower regions of the earth's surface. Even at this great altitude the dust was perpetually present in the air, and I became confirmed in the opinion that there is a permanent dust-shell inclosing the whole planet to a height certainly of about three miles (where direct observation has followed it), and not improbably to a height even greater; for we have no reason to suppose that the dust carried up from the earth's surface stops at the height to which we have ascended. The meteorites, which are consumed at an average height of twenty to forty miles, must add somewhat to this. Our observations with special apparatus on Mount Whitney went to show that the red

* From the *New York Daily Tribune*, Jan. 2.

rays are transmitted with greatest facility through our air and rendered it extremely probable that this has a very large share in the colours of a cloudless sky at sunset and sunrise, these colours depending largely upon the average size of the dust particles.

It is especially worth notice that, as far as such observations go, we have no reason to doubt that the finer dust from the earth's surface is carried up to a surprising altitude. I speak here, not of the grosser dust particles, but of those which are so fine as to be individually invisible, except under favouring circumstances, and which are so minute that they might be an almost unlimited time in settling to the ground, even if the atmosphere were to become perfectly quiet. I have not at hand any data for estimating the amount of dust thrown into the air by such eruptions as those which recently occurred in Java and Alaska. But it is quite certain, if the accounts we have are not exaggerated, that the former alone must have been counted by millions of tons, and must in all probability have exceeded in amount that contributed by meteorites during an entire year. Neither must it be supposed that this will at once sink to the surface again. Even the smoke of a conflagration so utterly insignificant, compared with nature's scale, as the burning of Chicago, was, according to Mr. Clarence King, perceived on the Pacific Coast; nor is there any improbability that I can see in supposing that the eruption at Krakatoa may have charged the atmosphere of the whole planet (or at least of a belt encircling it) for months with particles sufficiently large to scatter the rays of red light and partially absorb the others, and to produce the phenomenon that is now exciting so much public interest. We must not conclude that the cause of the phenomena is certainly known. It is not. But I am inclined to think that there is not only no antecedent improbability that these volcanic eruptions on such an unprecedented scale are the cause, but that they are the most likely cause which we can assign."

MR. RUSKIN ON A NEW STORM-CLOUD.

MR. RUSKIN gave on Monday a lecture at the London Institution on a new kind of storm-cloud which occurred to him, as a novelty, in 1871. He calls it "The Plague Wind," and would seem to have felt it very much. He commented with fiery wrath on the inaccuracy of "scientific people's" terms. Such folk could tell him about the moon and the seven stars, and how they moved and what they were made of, and he did not care a copper spangle how they moved and what they were made of: *he* (Mr. Ruskin) could not move them nor make them other than they were. But as the new storm-cloud had moved him and made him (apparently) other than he had been, he would like to know what it was. He would describe it accurately, not like "the scientific people." It always blew tremendously, giving the quivering leaves an expression of anger as well as distress! Its sound was a hiss, or as a whistling on a flute made of a file!! It polluted the character as well as enhanced the violence of the storm! The gloom was Manchester devil's darkness, sulphurous chimney-pot vomit (let scientific people note this) and blanched the sun instead of reddening it after the manner of healthy clouds. When filthy, mangy, miserable plague winds blew, the sun was choked out of the sky all day long! If they wished to see how the sun looked through a plague-cloud let them throw a bad half-crown into a basin of soap and water! If he were asked what might be the conceivable cause or meaning of all this—of blanched sun, blighted grass, and blinded man—he could tell them none according to their modern beliefs and knowledge; but he could tell them what meaning it would have borne to the men of old time. For the last twenty years England and all foreign nations, either tempting her or following her, had done iniquity by proclamation—every man doing, by the advice of his superiors, as much injustice to his brother as it was in his power to do. In such moral gloom, every seer of old predicted physical gloom, saying, "The light shall be darkened in the heavens thereof, and the stars shall withdraw their shining." What was best to be done? Whether they could bring back the sun or not, they could assuredly bring back their own cheerfulness, honesty, tranquillity, and hope. They might not be able to say to the winds, "Peace, be still;" but *they could check the insolence of their own lips and the troubling of their own passions;* and that it would be extremely well to do, even though the day were coming when the sun should be as darkness and the moon as blood.

We venture to express a hope that Mr. Ruskin will succeed in checking troubled passions and insolence of lips. As for accuracy of expression,—"mangy," "devil's darkness," "chimney-pot vomit"—we "have them all three ready."

THE CHEMISTRY OF COOKERY.

XXVIII.

By W. Mattieu Williams.

I NOW proceed to examine the chemical changes which occur in the course of the cookery of vegetable substances used for food. My readers will remember that I referred to Haller's statement: "*Dimidium corporis humani gluten est,*" which applies to animals generally, viz., that half of their substance is gelatine, or that which by cookery becomes gelatine. This abundance depends upon the fact that the walls of the cells and the frame-work of the tissues are composed of this material.

In the vegetable structure we encounter a close analogy to this. Cellular structure is still more clearly defined than in the animal, as may be easily seen with the help of a very moderate microscopic power. Pluck one of the fibrils that you see shooting down into the water of the hyacinth glasses just at this season, or, failing one of these, any other succulent rootlet. Crush it between two pieces of glass and examine. At the end there is a loose spongy mass of round cells, these merge into oblong rectangular cells surrounding a central axis of spiral tube or tubes or greatly elongated cell structure. Take a thin slice of stem, or leaf, or flower, or bark, or pith, examine in like manner, and cellular structure of some kind will display itself, clearly demonstrating that whatever may be the contents of these round, oval, hexagonal, oblong, or otherwise regular and irregular cells, we cannot cook and eat any whole vegetable, or slice of vegetable, without encountering a large quantity of cell wall. It constitutes far more than half of the substance of most vegetables, and therefore demands prominent consideration. It exists in many forms with widely differing physical properties, but with very little variation in chemical composition, so little, that in many chemical treatises cellular tissue, cellulose, lignin, and woody fibre are treated as chemically synonymous. Thus, Miller says, "Cellular tissue forms the groundwork of every plant, and when obtained in a pure state, its composition is the same,

whatever may have been the nature of the plants which furnished it, though it may vary greatly in appearance and physical characters; thus, it is loose and spongy in the succulent shoots of germinating seeds, and in the roots of plants, such as the turnip and the potato; it is porous and elastic in the pith of the rush and the elder; it is flexible and tenacious in the fibres of hemp and flax; it is compact in the branches and wood of growing trees; and becomes very hard and dense in the shells of the filbert, the peach, the cocoanut, and the *Phytelephas* or vegetable ivory."

Its composition in all these cases is that of a *carbo-hydrate*, *i.e.*, carbon united with the elements of water, which, by the way, should not be confounded with a *hydro-carbon*, or compound of carbon with hydrogen simply, such as petroleum, fats, essential oils, and resins. There is, however, some little chemical difference between wooden tissue and the pure cellulose that we have in finely carded cotton, in linen, and pure paper pulp, such as is used in making the filtering paper for chemical laboratories, which burns without leaving a weighable quantity of ash. The woody forms of cellular tissue owe their characteristic properties to an incrustation of *lignin*, which is often described as synonymous with cellulose, but is not so. It is composed of carbon, oxygen, and hydrogen, like cellulose, but the hydrogen is in excess of the proportion required to form water by combination with the oxygen.

My own view of the composition of this incrustation (lignin properly is called) is that it consists of a carbo-hydrate united with a hydro-carbon, the latter having a resinous character; but whether the hydro-carbon is chemically combined with the carbo-hydrate (the resin with the cellulose), or whether the resin only mechanically envelopes and indurates the cellulose I will not venture to decide, though I incline to the latter view. As we shall presently see, this view of the constitution of the indurated forms of cellular tissue has an important practical bearing upon my present subject. To indicate this beforehand I will put it grossly as opening the question of whether a very advanced refinement of scientific cookery may or may not enable us to convert nutshells, wood shavings, and sawdust into wholesome and digestible food. I have no doubt whatever that it may. It could be done at once if the incrusting resinous matter were removed, for pure cellulose in the form of cotton and linen rags has been converted into sugar artificially in the laboratory of the chemist; and in the ripening of fruits such conversion is effected on a large scale in the laboratory of nature. A Jersey pear, for example, when full grown in autumn is little better than a lump of acidulated wood. Left hanging on the leafless tree, or gathered and carefully stored for two or three months, it becomes by nature's own unaided cookery, the most delicious and delicate pulp that can be tasted or imagined.

Certain animals have a remarkable power of digesting ligneous tissue. The beaver is an example of this. The whole of its stomach, and more especially that secondary stomach the *cæcum*, is often found crammed or plugged with fragments of wood and bark. I have opened the crops of several Norwegian ptarmigans, and found them filled with no other food than the needles of pines, upon which they evidently feed during the winter. The birds, when cooked, were scarcely eatable on account of the strong resinous flavour of their flesh.

I may here, by the way, correct the commonly-accepted version of a popular story. We are told that when Marie Antoinette was informed of a famine in the neighbourhood of the Tyrol, and of the starving of some of the peasants there, that she replied, "I would rather eat pie-crust" (some of the story-tellers say "pastry") "than starve." Thereupon the courtiers giggled at the ignorance of the pampered princess who supposed that starving peasants had such an alternative food as pastry. The ignorance, however, was all on the side of the courtiers and those who repeat the story in its ordinary form. The princess was the only person in the Court who really understood the habits of the peasants of the particular district in question. They cook their meat, chiefly young veal, by rolling it in a kind of dough made of sawdust, mixed with as little coarse flour as will hold it together; then place this in an oven or in wood embers until the dough is hardened to a tough crust, and the meat is raised throughout to the cooking point. Marie Antoinette said that she would rather eat *croutins* than starve, knowing that these *croutins*, or meat pie-crusts, were given to the pigs; that the pigs digested them, and were nourished by them in spite of the wood-sawdust.

When I come to the other constituents of vegetable food it will be understood that the changes effected in their cookery are but nominal, and that nearly the whole business of vegetable cookery consists in rendering the cellular tissue more digestible than it is in the raw state; or in breaking it up to liberate its contents. When on the subject of cooking animal food, I had to define the cooking temperature as determined by that at which albumen coagulates, and to point out the mischief arising from exceeding that temperature and thus rendering the albumen horny and indigestible.

No such precautions are demanded in the boiling of vegetables. The work to be done in cooking a cabbage or a turnip, for example, is merely to soften the cellular tissue by the semi-solvent action of hot water; there is nothing to avoid in the direction of over-heating. Even if the water could be raised above 212° the vegetable would be rather improved than injured thereby.

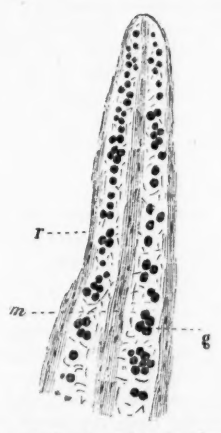
The question that now naturally arises is whether modern science can show us that anything more can be done in the preparation of vegetable tissue than the mere softening in boiling water. In my first paper I said that the practice of using the digestive apparatus of sheep, oxen, &c., for the preparation of our food is merely a transitory barbarism, to be ultimately superseded by scientific cookery, by preparing vegetables in such a manner that they shall be as easily digested as the prepared grass we call beef and mutton. I do not mean by this that the vegetable we should use shall be grass itself, or that grass should be one of the vegetables. We must, for our requirement, select vegetables that contain as much nutriment in a given bulk as our present mixed diet, but in doing so we encounter the serious difficulty of finding that the readily soluble cell wall or main bulk of animal food—the gelatine—is replaced in the vegetable by the cellulose, or woody fibre, which is not only more difficult of solution, but is not nitrogenous, is only a compound of carbon, oxygen, and hydrogen.

PLEASANT HOURS WITH THE MICROSCOPE.

By Henry J. Slack, F.G.S., F.R.M.S.

Among the most curious discoveries in natural history are those relating to the consortion, or dwelling together, of different plants or animals under conditions of enmity, utility, or neutrality. If a disease-producing organism fixes itself on a plant or animal, a one-sided warfare is the result. This kind of parasite lives to the serious loss of its victim. In other cases of parasitism no

such serious harm is produced, but no advantage is gained except by the invader. There are, however, many other cases in which two very different creatures live together as *commensalists*—Fellow-Boarders—and in some way promote each other's well-being. Fellow-Boarders may be free, or one fixed to the other. "Every fish," says Von Beneden,* "is a living and moving territory, on which a fauna is developed possessing special interest. When a small animal claims to profit by the fins of one larger than itself, accompanies it in its chase, and picks up spoils which the larger one disdains or abandons, we see none of the motives which characterise parasitism." In the paper from which this passage is quoted many interesting cases are mentioned; and one of the most curious occurs on our coasts, where the sea anemone, *Adamsia palliata*, attaches itself to the shell occupied by a soldier-crab. The anemone gets the advantage of the crab's locomotion—in fact, keeps his carriage—and for some reason its presence is so pleasant to its coachman, that he helps to feed it and looks after it when he changes his shell. Passing from examples of the free fellow-boarders, we may come to others connected inextricably for life, and perhaps the most remarkable is the union of fungi and algæ to form lichens. This permanent lodging and growing together is called *symbiosis*, or life partnership, and may be understood by the microscopical examination of any of the common lichens hanging from foliage or trees. The reader who wishes to investigate this matter is very likely to gather *Ramalina farinacea*, a greyish, greeny, mealy-looking, moss-like tuft. If not wet and soft, it should be soaked well in water, and some of the thinnest possible slices cut with a sharp penknife from one of its slender branches. If these are examined with a power of about 300 in a drop of water under the microscope, some of the pieces will look like a fragment of the annexed figure, copied from Sachs, but to make a clean and perfect section requires care and skill. It will be seen that the lichen is composed of layers of different materials, and that the grey or colourless structure encloses green cells—the black dots in the sketch. If these are compared with some



Usnea Barbata—Longitudinal section of a slender branch, soaked in potash solution (*r*, the cortex; *m*, loose medullary tissue; *g*, the gonidial layer).

of the simple algæ that give a green colouring to wet stones, a family likeness will at once be seen, and the observer will also notice in the colourless portion of the lichen, tubular threads like those of common moulds. This complex character of lichens was long a puzzle, but a few years ago Schwendeuer startled biologists and enraged lichenologists by declaring their favourites to be fungi parasitic upon algæ, and, although recent investigations relieve the fungi from the bad character of parasitism, the lichen has been proved to afford an instance of life partnership.

The general character of fungi assimilates them in some particulars to animals. They do not, like true plants, digest carbonic acid, but obtain their nutriment from matter that plants or animals have already organised. The typical plant contains chlorophyll, the peculiar green matter of leaves, and by its means, under the stimulus of light, they decompose carbonic acid, use the carbon to build up their own structure, and evolve oxygen gas, which they also take up, as animals do, in their process of respiration. "Algæ," as Sachs observes, "are never true parasites, although they very commonly live upon other plants." Fungi, as all know, can live in the dark, and many hate the light.

The chlorophyll of algæ, as in many sea-weeds, does not always give a green tint to the plants. The colour may be masked by red or brown, or other pigments, and, as Mr. Sorby has shown, the chlorophyll of the higher plants comprises several materials. If the green cells of the algæ in a lichen are removed they will grow in moisture, and lead an independent life, and various experimenters—Stahl in particular—have produced lichens by placing the algæ under circumstances that enabled the fungoid filaments to embrace them. In a recent lecture, delivered before the Botanical Society of Belgium, M. Leo Errera imagines a fungus of the Ascomycetes sort* meeting with a suitable algue, and thus making love to her:—"Mademoiselle, there are vast desert regions which I have a great desire to colonise. Deign to unite with me, for they are not habitable for either of us separately. Delicate as you are, you would be roasted by the sun; you would not be able to fix yourself and absorb the animal aliments which are indispensable for you. For my part, I am more capable of endurance: I could stick myself tight, but I should not find the organic substance I require, and I have not, like you, the talent of feeding upon air, and especially carbonic acid. Let us associate, and we two will reign over immense spaces, where there is none to challenge us. You will supply the household with organic matter. I will shelter you. I will attach myself to the soil, from which I will extract the inorganic substances required for our common interest." The algue can only reply, "Willingly, sir." The bargain is concluded—the lichen is made.

M. Errera says the algues which act as gonidia to the lichens belong to divers groups—green or bluish *confervæ*, *palmellaceæ*, *nostocs*, &c. On the other hand, he observes, we do not see why the *Ascomycetes* alone of fungi should have the privilege of making lichens, and in fact it has been recently shown that in lichens belonging to the genera *cora* and *rhipidomena* the fungus is not an Ascomycete, but a basidiomycete allied to *stereum*.†

Lichens are remarkable for longevity, and some of the rock-adhering kinds are believed to reach the term of a thousand years. The union of fungus and algue, each belonging to organisms classed low down in the biological series, thus leads to a connection that outlasts many generations of human beings, and survives their cities' decay.

* See *Student and Intellectual Observer*, vol. v., p. 143.

* Having fructifying bodies, *sporidia*, enclosed in sacs *asci*, the morell belongs to them.

† *Stereum hirsutum* is the pretty flat banded fungus that grows in roundish projections from rotting wood.

THE AMERICAN ENCYCLOPÆDIA.*

THE action of the laws of international copyright, or rather the effect of the absence of a law of copyright between Great Britain and America is illustrated somewhat singularly by American Cyclopædias. Americans have an excellent Cyclopædia, known as Appleton's because published by Messrs. Appleton of Broadway, New York. In many respects that work contrasts favourably with our best cyclopædias; but it is hardly necessary to say that a work in sixteen not very thick octavo (imp.) volumes cannot contend in fulness throughout with the series of thick quarto volumes constituting the "Encyclopædia Britannica." The very completeness of "Appleton's Cyclopædia" makes a difference of scale an absolute necessity,—though it might be readily shown that many subjects are treated much more satisfactorily in the smaller American than in the larger British work.

Failing a cyclopædia of their own on the scale of our chief work of the kind, the American public have largely used the "Encyclopædia Brittanica," Chambers' "Cyclopædia," and other works of the sort, of which pirated editions (we use the word in no offensive sense—properly published editions would simply be sold at a loss in America) have been issued at a price bringing them into favourable competition with home productions. But our British cyclopædias are, on the one hand, very uneven in treatment, and, on the other, they are not in all respects perfectly suited to the American public,—which is very "live," and demands therefore the latest information about peoples, countries, inventions, and discoveries. Even accounts of living persons which our British cyclopædias are for the most part careful to exclude, form not only a desirable but an essential feature in a truly American work of reference. In other directions—less questionable perhaps, (for men's works, not their lives, should concern us)—Americans seek much earlier and more complete information than suffices for the old-fashioned Britisher.

It has been to meet this demand that the *Encyclopædia Americana* has been designed. It is intended, as stated in the preface, to supplement and accompany the great encyclopædias, completing them in particulars where they appear deficient and bringing down to the latest date their statements and descriptions.

Regarded with due reference to its purpose (and we regret to notice that in more than one review which has appeared on this side of the Atlantic, the expressly stated purpose of the work has been entirely and most unfairly overlooked) the *Encyclopædia Americana* is a marvel of fulness, and in most cases of accuracy of information. Among those cases in which matters are not stated with perfect accuracy may be cited certain statements respecting European persons of prominence in dynastic, political, and military affairs. These mistakes do not concern us here, nor perhaps do they matter much anywhere; still if such matters are introduced into a Cyclopædia "of Arts, Science, and General Literature," it is as well they should be given accurately. Persons with fairly good memories who followed with interest the events of the Franco-German war will note here several remarkable mistakes. Even the account of the cause of the Prince of Wales's illness in 1871 might have been given correctly in the same space as the incorrect cause here mentioned. (In glancing over the article on this gentleman, we note with some amusement what looks really like a travestie of an old and ludicrous story. We have all heard how one who spoke of the birth of some king's "daughter" was gravely told it was "not a daughter but a princess;" here, however, we have an almost funnier combination, being informed that the Prince of Wales "has five children, two princes and three princesses!")

When we return, however, to such articles as those on Agriculture, Ants, Architecture, Artesian Wells, Birds, Bridges, and a host of others which might be mentioned, we forget such slips in matters of no real importance. These are altogether admirable, carefully written, excellently illustrated, and brought closely up to the present time. Some articles, as those on Bacteria and the like, relate to matters about which all our really valuable information has been obtained since the current edition of the "Encyclopædia Britannica" was commenced. The question is suggested whether the plan of publishing a large cyclopædia in a series of volumes produced according to their alphabetical order might not be improved upon. Why, for instance, should the present edition of the "Encyclopædia Britannica" be (for the moment) up to date in regard to Meteorology and altogether out of date in regard to Astronomy? By the way, we see with some surprise that the "Encyclopædia Americana" adds nothing on the subject of Astronomy (except three short articles on the Altazimuth, Asteroids, and the Astrolabe) to what the editor of Knowledge (who also contributed the articles on Astronomy to Appleton's "Cyclopædia") has given in the "Encyclopædia Britannica" on the subject. The nine years which have passed since the present edition of this work was begun have been far from unfruitful in astronomical discovery. We trust that in the treatment of special astronomical subjects this will be rectified.

Many of the articles in this excellent cyclopædia while specially valuable to Americans will be exceedingly interesting to us on this side of the Atlantic. Those relating to matters,—as laws, customs, manners, modes of speaking, and so forth,—in which our cousins over the "big water" differ from ourselves are full of interest. Amongst such articles may be cited especially Americanisms, American literature, Army, Adultery (showing the variety of American law thereon), Blind (America takes singular care of the afflicted), &c. Articles relating to the separation of the States from the mother country, or to circumstances in American history connected with that event, also possess (or should possess) great interest for British readers. The struggle for just rights which with us ended without actually displacing from (titular) sovereignty the lineal representatives of those exemplary freebooters, Cerdic the Saxon and Rollo the Norman, ended otherwise in America. But this does not in reality separate us more from our kinsfolk across the water than we must in any case have been eventually separated as they rose in power and influence among the nations. Most unfortunately separation was not effected without fighting: but Americans have long since learned to blame for this those really responsible, not a nation as much wronged as themselves by the wrong-headed obstinacy which caused the contest. The progress therefore of America as a nation is as full of interest for all Britons, save the unwise and narrow-minded, and is viewed with feelings as free from all lingering trace of the animosity engendered during conflict, as if no struggle had taken place. So viewing matters American, a large portion of the volume before us has a special interest on this side of the Atlantic. The rest of the work forms a most valuable supplement to our chief national cyclopædia. Every part of the work in fact is valuable, except only those few passages relating to matters European where errors have been made in matters which after all are of no intrinsic importance.

* *The Encyclopædia Americana*: a Supplemental Dictionary of Arts, Sciences, and General Literature. Illustrated. Vol. I. A—Cen. (J. M. Stoddart: New York, Philadelphia, London.)

SONG AND SPEECH.*

HOMER, the great singer of old, takes articulate speech as the distinguishing characteristic of man, creating by poetic insight a more perfect definition than the philosophers of Greece in later times could frame after careful thought. This divine gift of speech with its near kinsman song, this distinctively human power, is treated by most as if it were a possession needing neither culture to improve nor care to preserve. Though scarce one person in a hundred can use his voice either in speech or song as it might be used, though hundreds lose their voices or all the beauty from their voices many years before advancing years might fairly be expected to rob the vocal organs of their power, yet scarcely any seem to learn the lesson so often taught, or to note the warning thus often conveyed. Such a work as the present, therefore, is much needed, and deserves the careful attention not of those only who have to employ the voice professionally, whether in singing or speaking, but of all who care for the voice. We may apply specifically to this case the general saying of the great teacher of our age. "If any one doubts," says Mr. Herbert Spencer, "the importance of an acquaintance with the principles of physiology as a means to complete living, let him look around and see how many men and women he can find in middle or later life who are thoroughly well." If any doubt the importance of knowledge respecting the principles of vocal utterance and vocal culture let him consider how few men and women in middle or later life have the thorough command of their vocal organs.

In this work, the authors, one with wide experience in vocal and aural surgery the other especially skilled in vocal training, deal first with the laws of sound bearing on the voice. It will interest some to know that the lowest tone yet attained, so far as is known, by a bass voice, is F_{III} (with 44 vibrations per second); while the highest on record is that of Bastardella who is said to have sung B^{II} (with 1,980 vibrations per second). This gives as the entire range of the human voice about five octaves and a half.

It is worthy of notice that the tones of a good bass voice have at least twenty partials. The quality of a tone depends on the number of partials of which a tone consists, on their relative position, and on their relative degrees of loudness. Simple tones though soft are wanting in power; musical tones with a moderately loud series of the lower upper partials are richer and more harmonious. With only uneven partials the tone is hollow; and when a large number of the upper uneven partials are present *nasal*. High partial tones of considerable strength give to the voice a rough and strident tone. Though the human voice resembles a reed instrument in many respects yet the comparison requires some qualifications.

Our authors next consider the organs of song and speech. In dealing with respiration they touch on the curious difference of breathing in men and women which every one who has ever noticed operatic singers must have recognised,—viz., that with men the action of the midriff (shown by abdominal movement) plays the chief part, while with women the greater part of the work is done by the extension of the ribs sideways (lateral or costal breathing).

The description of the voice-box or larynx is very full and complete. It is illustrated not only by numerous drawings, but by photographs of Mr. Behnke's larynx while he was in the act of singing. As objection might be taken to these photographs on the imagined plea that no one can possibly produce a pure vocal tone with a mirror at the back of his throat, it may be well to note that Mr. Behnke has repeatedly put this matter to the test, showing his larynx to eminent musicians, who agreed that no fault could be found with the quality of his voice under laryngoscopic observation. Our authors state also that in some cases the power of thus producing pure vocal tones under these conditions is present from the beginning, while others acquire it so soon as they become accustomed to the touch of the mirror.

Vocal hygiene occupies as it deserves a most important position in this volume. Diet, exercise, and dress are duly considered. A subject which last year occupied a good deal of space in these columns is touched on in passing. It may be remembered that "A Lady" speaking of the divided skirt and of the effects of a change of dress which if properly made cannot be detected by the keenest observer, said that the power of the voice was greatly increased when that light but warm skirt was worn and stays were no longer necessary. We can hardly wonder when we learn that stays, "even where the charge of *tight*-lacing cannot be made, but the corset is of unyielding materials" diminish the breathing power as tested by the spirometer by one-third. (Illustrative cases were published in KNOWLEDGE). Of course to observations of this kind "An Observer" might oppose any number of old ladies who have survived long years of pinching by which a third of the supply of air nature fitted them to breathe was excluded. But we are here considering respiration only as part of the vocal apparatus, and however clearly it may be shown by "Observers" that women were unwisely provided with half as much lung power again as they really want, vocal requirements—as tested experimentally—are certainly not provided for in excess by a wastefully beneficent Nature.

The later sections on the Reach of the Voice, Daily Life of a Voice User, the Ailments of a Voice User, and Defects of Speech are full of interest and value. We can cordially recommend this work as the most thoughtful and suggestive treatise on the voice known to us. We hope before long to find space for several passages as paragraphs which we had marked for quotation in the course of this review.

* *Voice Song and Speech:* a practical guide for singers and speakers; from the combined view of vocal surgeon and voice trainer. By LENNOX BROWNE, F.R.C.S., and EMIL BEHNKE. 2nd edition, Sampson, Low, Marston, and Rivington: London.

DRAWING THE PLANETS.

BY A FELLOW OF THE ROYAL ASTRONOMICAL SOCIETY.

THE excellent and instructive paper by Prebendary Webb, which appeared on p. 302 of the last volume of KNOWLEDGE, can scarcely fail to have induced a considerable number of our younger students of the heavens to attempt the delineation of some of the details with which the face of the moon is crowded. Almost certainly, its gifted author would find his chief reward in learning that his plain and perspicuous directions had had this effect; ensuring, as this must do, a real and substantial addition to our Selenographical knowledge. The moon, however, is by no means the only body in the sky of which it is important that drawings should be made. Probably, in no way could our knowledge of the physical structure of the planets be more greatly advanced than by the comparison of numerous carefully-executed and accurate sketches of their superficial detail, made at sufficient intervals; and very notably does this apply to the three bodies immediately exterior to the earth: Mars, Jupiter,

and Saturn. It is more especially, then, to facilitate the delineation of these particular planets that the present paper is written. We do not, however, mean here to enter into the question from an artistic point of view; all we propose to do is to instruct the student how to draw the *outlines* of the planets with ease and accuracy; as this always forms a stumbling-block in the way of the beginner. Commencing with Mars, he is, at present, sensibly circular; and subtends an angle of some 17″. Hence we need only take a pair of compasses, and with centre C′ (Fig. 1) and a radius C′A or C′D of half-an-inch,

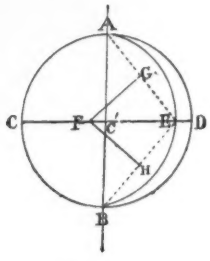


Fig. 1.

describe a circle A C D B—of course 1 in. in diameter—to obtain the outline we require. But Mars is sufficiently near to the earth to exhibit a sensible phase, and when near "quadrature" with the sun is very perceptibly gibbous—or like the moon about a couple of days before or after she is full. Suppose, then, that we wanted to draw the outline of Mars on May 15. Turning to p. 468 of the "Nautical Almanac," we find that only 0·9 of that diameter of the planet passing through the sun is illuminated (this is not a strictly scientific description, but will be better understood than "the versed sine of the illuminated portion of the disc"). Let C D be this diameter, and A B one at right angles to it. Then C E will be the part in light. First, with centre C′ as before, and radius C′D, describe the circle A C B D. Measure off one-tenth of C D to E. Join A E, B E, and bisect A E in G and B E in H; from G draw G F at right angles to A E and from H, H F at right angles to B E. Finally, from F, where these last two lines intersect, and with radius F E or F A, describe the arc A E B. Then will A E B C represent the outline of Mars at our specified period.

If now we try to draw Jupiter as we see it in the telescope, we perceive at once, from its pronounced elliptical outline, that it is impossible to do so, merely by the aid of compasses at all. The equatorial diameter of Jupiter just now approaches 43″, so that, adhering to our original scale, we may represent this in Fig. 2 by $e\,q$, which we must make equal to 2·4 in. The preface to the "Nautical Almanac" tells us that Jupiter's polar diameter is only ·939 of his equatorial one, so that we take $p\,a = 2{\cdot}25$ in. Then from the centre c, where the two diameters cut each other (of course, at right angles), we take the distance $c\,e$ or $c\,q$ in the compasses, and placing one leg of the compasses on p or a, move them about until the other leg touches the line $c\,q$ in the points f and f'. Into these points, technically called the *foci* of the ellipse, we stick two pins, and round them lie a loop of thread of such length that when stretched tight by a pencil, the pencil point shall just touch either a, e, p, or q. $f\,p\,f'$ represents this thread in our figure, and if it be kept tightly stretched as the pencil be carried round, the curve $p\,e\,a\,q$ will be the correct elliptical outline of Jupiter to our adopted scale.

The description of the outline of Saturn and his rings only involves a repetition of this process. Its successive steps will be understood by the study of Fig. 3.

As the diameter of Saturn was 17·8″ on January 14 of the present year, we revert to our original scale of 1 inch for the equatorial diameter of the planet. But he is even more elliptical than Jupiter, his polar axis only measuring ·895 of that passing through his equator; so, to begin with, we

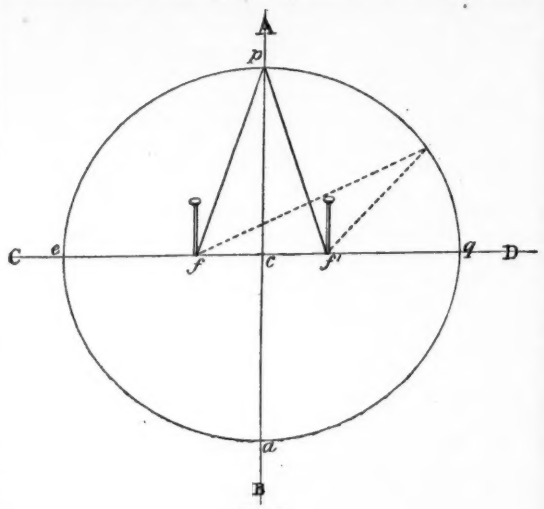


Fig. 2.

have $e\,q = 1$ inch, and $p\,a = {\cdot}895$ inch. As before, with one leg of the compasses on p or a, and with the distance $c\,e$ or $c\,q$, we find the foci $f\,f'$, and describe the outline of the ball of the planet. From p. 468 of the "Nautical Almanac" we ascertain that, at the epoch chosen, the outer major axis of the outer ring $o\,d$ was 44·62″. and its outer minor axis $i\,d'$ 19·11″; converting these into linear measure by a rule-of-three sum we find $o\,d = 2{\cdot}5$ inches,

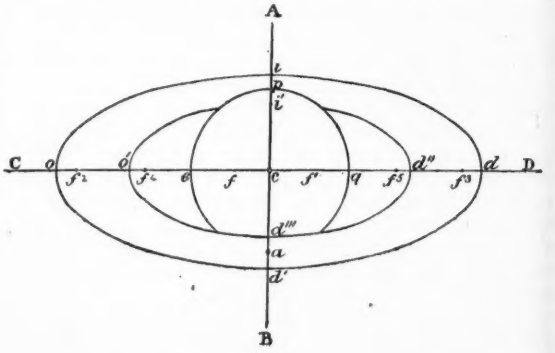
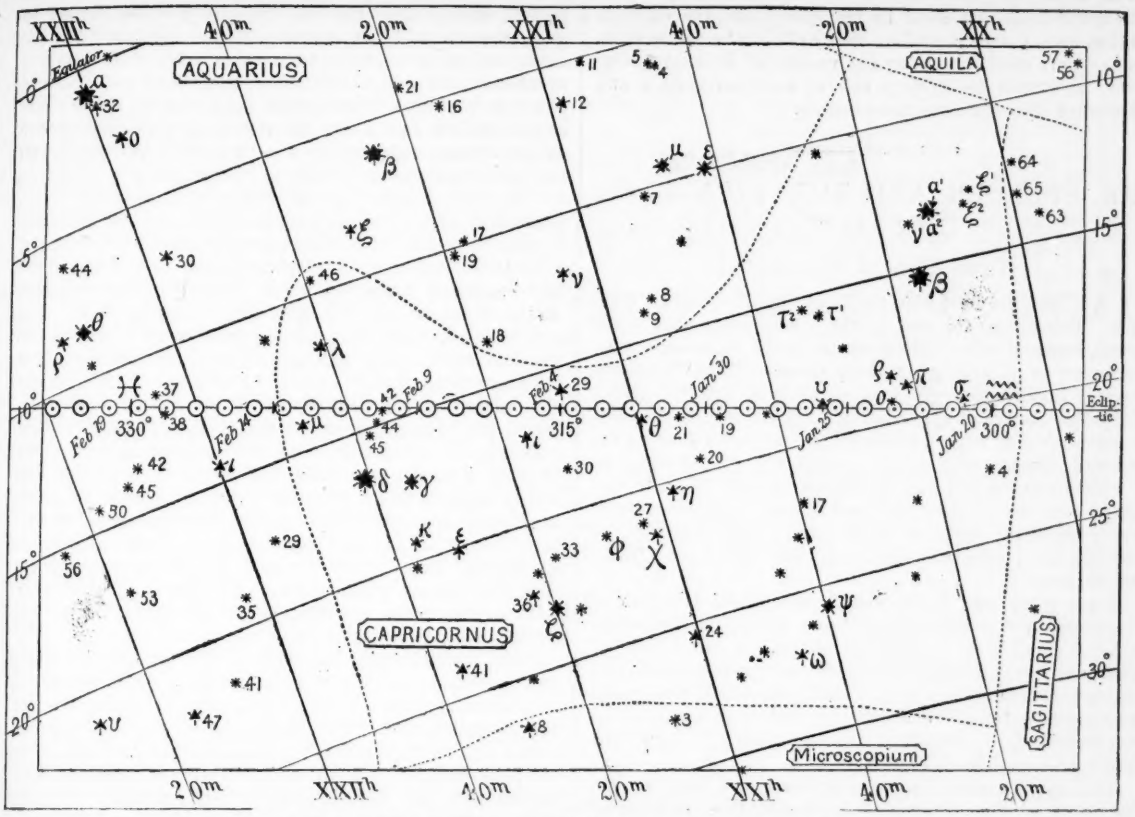


Fig. 3.

and $i\,d' = 1{\cdot}07$ inch. In like manner we find that the inner major axis of the inner ring $o'\,d''$ was 29·67″, and its inner minor axis $i'\,d'''$ 12·71″; quantities which, as before, we turn into 1·66 inch and 0·72 inch respectively. Then, in the manner explained two or three times previously, we find the foci f^2, f^3, and f^4, f^5, insert our pins, and describe the ellipses to which they respectively pertain; the result being shown in our figure.

Possibly by this time the beginner who has followed us so far may feel tempted to exclaim, "Good gracious! am I to go through all these elaborate reductions of angular into linear measurements, these findings of foci, sticking



The Zodiacal Sign for February, with the Sun's path from day to day.

in of pins, carefully tying loops of thread of a rigidly accurate length, and all the rest of it, every time I want to make a drawing of Jupiter or Saturn?" To which we would reply, "Certainly not." The outline of Jupiter is, for our present purpose, absolutely invariable, while those of Mars, and especially those of the Saturnian system, vary so slowly that the outline once drawn will be sufficiently accurate for many weeks. All, then, that the student has to do is to transfer such outline to a sheet of what is called in the shops latten-brass, and, cutting it very carefully out, to thus make a stencil-plate. This is held firmly down on to the paper, and very thick Indian-ink rubbed over and round it with a stencil-brush or tooth-brush with the hairs cut short, the result being a white figure of the planet on a black background. If latten-brass cannot be procured card may be used, but the brass will be found the more satisfactory of the two. Furthermore, for the mere purpose of obtaining an outline, a sharp-pointed pencil may be run round the edges of the stencil-plate, although the Indian-ink will be found much more effective. In this way we have ourselves for some years past prepared outlines of the planets for the purpose of sketching, with results so successful that we unhesitatingly recommend it to all who may care to address themselves seriously to the very interesting task of delineating the detail visible on the surfaces of our nearest neighbours in space.

The delay in the appearance of the papers on the "Planets in a Three-Inch Telescope" has had its origin wholly and solely in the recent extraordinarily bad weather. Every single object referred to in this series of articles has been actually seen, drawn, and described *at the telescope*, and it has been the impossibity of even catching a glimpse of those remaining to be treated of, which has compelled us to defer the concluding essays of the series.

THE DAY SIGN FOR FEBRUARY.

WE give this week the sign of the Zodiac—viz., Aquarius—through which the sun passes in February. It must be noticed that the sun's path as indicated along the ecliptic in this chart, does not correspond to this current year 1884, nor indeed exactly to any year during many last past or to come, but to the month of February in a year supposed to have begun at solar noon on the preceding March 20 with the sun just entering the sign Aries. The sun's place is not quite one day's journey wrong for any year, as represented in this map; but since each year there arises nearly a fourth of a day's difference in the time of the sun's entering Aries or any other sign, no set of maps can show the sun's daily position for all years.

It will be noticed that at this part of the year the sun's path crosses the meridians aslant, but at parts where they lie nearer together than on the equator. The slant of his course would make the sun take a longer time in passing from meridian to meridian than if he crossed them squarely. The greater proximity of the meridians would make him take a shorter time than when near the equator. The two causes of difference about counterbalance each other, so that

so far as they are concerned he would cross the meridians at about the same rate as if he travelled along the equator. But as he is nearer perihelion than aphelion he passes them rather more quickly. After the middle of February, however, he attains his average rate of meridian passage and thereafter falls more and more behind.

MR. SPENCER AND THE *EDINBURGH REVIEW*.

[*To the Editor of* KNOWLEDGE.]

AS I shall not be within reach of Mr. Spencer's "First Principles" for two or three weeks, and as it is not usual, even it the hottest controversy, to charge your adversary with making "garbled extracts," and "omitting several important words" in quotations, without giving people the means of appreciating such charges on the spot, I must ask you to print the whole passage (showing the omitted words) which you charge me with having so "misrepresented"—from his fourth edition, mind, in case there been any change. If I did it was doubly contrary to my intentions—first, to quote fairly, and, secondly, to exhibit his prolixity in full, as I said. Till I see it I can say no more.

I am sorry you find yourself unequal to the task of "parsing" my sentence which you quote, and invent an absurd parallel to "which we should be sure to be told that we have misunderstood, or overlooked qualifying statements somewhere else." Do you think you could manage to parse, "We should be told that we had misunderstood *it*, or overlooked something else"? And what is the grammatical difference?

It is equally good for my argument and bad for Mr. Spencer's, whether Newton's "Axioms or Laws of Motion" depend upon experience or are necessary truths; and I dealt with both alternatives. So I ask with perfect indifference as to that, whether you consider Newton's references to experience thereon real and sufficient proofs, or only illustrations for common people of what he perceived to be necessary truths.

Altogether your review of my review is about the best compliment it could receive from such an ardent Spencerian as you. And as other ardent Spencerians are doubtless satisfied with it, we are pleased all round, and I need ask no more questions.

THE EDINBURGH REVIEWER
Feb. 2. OF SPENCER'S "FIRST PRINCIPLES."

[I should be glad to think the "Edinburgh Reviewer" regarded my note on his review as a compliment, though scarcely "the best it could receive." I can assure him that at least one sentence in my note (for my paper is no review) is intended in a complimentary sense. I have seen many attacks on Mr. Spencer, but before his none which saddened me in the reading. The coarse vituperation and vulgar ridicule with which some have assailed Mr. Spencer have excited other feelings than sadness. That such men as *they* should abuse what they have not even attempted to understand, has been but too easily understood. It is otherwise with the "Edinburgh Reviewer." But I say no more on that point.

The word "garbled" was ill-chosen; I should have said, simply, "imperfect." I am certain the reviewer did not intentionally mutilate the passage. That he should have copied the passage imperfectly, read it in MS., corrected it in proof, and yet failed to see that it was imperfect, shows not wilful mutilation, but want of interest in the subject-matter of the passage, and *a fortiori* of the treatise from which that passage was quoted—the only passage he thought fit to quote unreduced. Yet it *was* reduced. I quote (from the same edition) the sentence from which words were dropped, unintentionally no doubt but *very* significantly:—"If x and y are two uniformly connected properties in some outer object, while a and b are the effects they produce in our consciousness; and if, while the property x produces in us the [indifferent mental state a, the property y produces in us the] painful mental state b (answering to a physical injury); then all that is requisite for our guidance is, that x being the uniform accompaniment of y externally, a shall be the uniform accompaniment of b internally." The bracketed words are those omitted. The omission makes nonsense of the passage. Very probably the reviewer can show that his remarks were intended to relate to the complete passage. But it is noteworthy that the properties which he considers in the case of a tiger do not correspond with Mr. Spencer's statement. They are beauty and ferocity, producing the pleasing (not indifferent) sensation of admiration and the painful sensation of physical injury. Moreover the abstract proposition as finally stated is that "when we always find some harmless or pleasant appearance accompanied by some noxious property, we know that we had better keep clear of it w th out further inquiry," which has no real correspondence with Mr. Spencer's proposition. To show this it is only necessary to point out that the latter would begin "If noxious properties *are* avoided," &c.

I am not surprised that the critic of Mr. Spencer's grammar claims accuracy for a sentence which neither I nor he could parse; because the boldly irregular form of the sentence is one of the characteristics of his writing. I rather like it, though it *is* unparsable. I only touched on the point because he sneers at Mr. Spencer's grammar, who occasionally, like himself, trusts in the reader's sense to connect right and not wrong words together. I will content myself by pointing out that in the sentence, as it stands in the *Edinburgh Review*, there is only the context to show that "overlooked" belongs to "we should be sure to be told that we have" and that the "which" on the other side, though it is to be connected with "we have misunderstood" is not to be connected with "we have overlooked." Once you put "it" after "misunderstood", all is right: it belongs *there* to "misunderstood" and not to "overlooked;" but where the reviewer puts its relative "which," it belongs to both "misunderstood" and "overlooked,"—grammatically to one, quite ungrammatically to the other.

I did not touch on the reviewer's argument respecting the laws of motion, only on his statement that Newton advanced them as necessary truths, whereas Newton regarded them as established by Induction,—or, as Whewell says in speaking of the first and simplest, "Men culled the abstract rule out of the concrete experiment."

If my notice of his review pleases the reviewer it is well; yet not nearly so well as it would be if he had seen that he has thoroughly misapprehended the teaching of the philosopher he has attacked. That I am not so ardent a Spencerian but that I can examine Mr. Spencer's propositions dispassionately, and criticise them as keenly as if they came from one whose general teachings I disliked, I have shown in my article here on "The Family of Small Planets." That the usually keen and clear-seeing mind of the "Edinburgh Reviewer" is not so dispassionate is shown throughout his review. If I could here find space to review instead of merely noticing that review, I could make this abundantly clear. I have cited but one really important instance, his

travestie of Mr. Spencer's remarks about a First Cause. Here is another, of many such :—Mr. Spencer has shown wherein all forms of religion agree, viz., in "the consciousness of an Inscrutable Power manifested to us through all phenomena." His reviewer finds that in just this respect religions have differed widely,—as though the thought did not underlie belief in many gods as certainly as it underlies faith in but One Supreme Power. On the other hand, he says that all religions have agreed in just that one point where Mr. Spencer says they have differed, namely, in professing to know the ways and attributes of the several deities or of the single Supreme Being they have acknowledged. I rather wonder what a lawyer would say if he were told that he must not question the statements of witnesses who gave irreconcilable accounts of some event, seeing that although no two of them agreed they were all at one in claiming exact knowledge of those very matters about which they made contradictory statements.

Throughout, the review is unfair in this way,—not wilfully I am sure; but the writer simply cannot see a single pleasing tint through his sad-coloured spectacles, and unfortunately he *will* wear them. That in dealing with views thus distasteful to him he should find dulness and prolixity where others find only sufficient fulness of elucidation is altogether natural.

As perhaps the best way of answering the sarcasms of the *Edinburgh Review* I propose in the next number of Knowledge to illustrate, by an extract from "First Principles," the calmer and more dignified tone of the philosopher attacked. The extract, already in type, is entitled "Patience and Courage for the Truth." R. P.

The Edison Company is said to have 22,500 lamps in use on the Continent, of which 7,000 are in Germany, 4,500 in France, 4,000 in Austro-Hungary, 3,000 in Russia, and 2,200 in Italy.

Morning Glow.—Professor Guy, of Saint Louis, Perpignan, France, writes to *Cosmos Les Mondes* that at 4 a.m. on the 8th ult., on getting out of bed, and before lighting the candle, he saw the reflection of a flash of lightning in his room. He ran to the window and saw a beautiful whitish glow extending over the whole of the southern part of the sky, from the horizon to the zenith. His window, he says, looked south, and he could see nothing of the northern part of the sky. It being 4 a.m., and the moon having set at Perpignan at 2 hours 42 minutes, Professor Guy says that what he saw could not possibly have been clouds lighted up by the moon. Along the southern horizon was a band of black clouds of about 15° in height. The upper part of this band was illuminated at intervals by flashes of lightning like those seen in summer. This intermittent illumination was undoubtedly, says the professor, due to lightning, but the cause of the general glow, which lasted till a quarter to five, when the sky became clouded over, is not so easy to determine, though it may be attributed to electricity. Possibly the upper currents of electricity flowing towards the poles are able to illuminate the layers of rarefied air which they traverse, and to give us the feeble whitish glows which are sometimes seen. Such was probably the cause of the effect seen at Perpignan, and the professor thinks that the frequent flashes of lightning which illuminated the horizon showed that there was a great deal of electricity in the air, and gives some semblance of truth to his supposition.

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THE FELLOWSHIP OF THE LEARNED SOCIETIES.

[1110]—There is probably no single subject on which the genera public is so misinformed and ignorant, or in connection with which so much popular misapprehension exists, as that of the value and significance of the letters which indicate the membership or fellowship of the so-called "learned societies"; and which are found appended to the names of so many merely notorious as well as really eminent men; to say nothing of those of the crowd of nobodies who claim the right to use them. There can be no greater mistake than to imagine that, because a man puts the letters F.R.S., F.R.A.S., F.G.S., F.L.S., F.R.G.S., F.S.A., &c., &c., &c., after his name, he has, merely on that account, any more claim to be listened to than the veriest penny-a-liner or contributor to a "half-penny dreadful." For it can never be too widely known that while every competitor for the humblest post in the public service has to submit to a preliminary educational test of fitness, no examination of any sort or description is exacted from the aspirant to the fellowship of a single one of the associations of which I am speaking. All that is needful in the majority of cases is that the candidate shall have his nomination paper signed by three or more Fellows of the Society he wishes to enter; and that *nothing whatever, good, bad, or indifferent, shall be known about him.* I am careful to emphasize this last condition, inasmuch as the government of the societies, one and all, has drifted more or less into the hands of cliques, who will take especial care to exclude any man personally unpopular with their own members, be his scientific attainments what they may; while, on the other hand, a man may have publicly paraded such crass and extraordinary ignorance of that branch of science for whose promotion a particular society was founded and chartered, that the consensus of the whole of the Fellows as to his manifest unfitness must insure his rejection. I repeat, then, that the person who may cherish the most reasonable hope of writing any given combination of letters after his name is he of whom the members of the society he delights to honour are in previous ignorance.

Viewed in this aspect, the condition of every one of the learned societies is, in one sense, deplorable. Two of them—the Royal Astronomical and the Royal Geographical Societies—seem especially singled out by a certain class of advertising schoolmasters and tradesmen as a means of advancing their respective businesses. These gentry get elected (heaven only knows how, in many cases, they find people even to nominate them!), and forthwith the advertisement columns of the newspapers announce chronically that "The Salisbury Plain Universal Educational Institute is conducted by T. Brown, Ph.D., F.R.A.S.," or that "The Soudan Portable Cooking Apparatus can be obtained only from J. Robinson, F.R.G.S., &c." The odds are heavy against "Dr." Brown knowing altitude from aberration, or North Polar distance from azimuth; while it is more than likely that Robinson could not say off-hand where Tiflis is, even to save his soul alive. To the outside public however, the half-educated pedagogue and the puffing shopkeeper, seem in some sort to rank with an Airy or a Markham. But, it may be imagined that, granting that this is true, surely the *fons et origo* of all the Scientific Societies, the oldest of them all, the Royal Society, stands in a different category from its so comparatively recent progeny, and the Fellowship of that Society which has numbered Newton, Wren, Davy, Faraday, Wollaston, and Young among its members, must confer honour and afford testimony

of scientific status, utterly underivable from association with the more special ones. Alas! for this delusion. What the Royal Society once was and what it now *is* are two very very different things indeed. What I have said above about government by a clique applies perhaps more strongly in its case than in almost any other. At present it is "worked" and exploited by a compact association for their own benefit and that of their friends; and the chances of election of any given candidate depend very largely indeed upon his capacity and inclination to go with the stream and make himself useful to the wire-pullers. Let anyone study the lists of elected candidates during the last few years and note the number of obscure doctors, dummy astronomers, pseudo-chemists, and the like, who now dub themselves F.R.S., and a better idea will be gained of the value of this "distinction" than can be derived from any iteration of what I have previously said, either in the way of illustration or application. A man must have a distinct taste for some branch of science, be "a good fellow," and be orthodox in the views of the dominant clique in the matter of assaults on the public purse. Possessed of these qualifications he need not be either an Airy, an Owen, a Crookes, or a Geikie; the mere fact of his having them, in conjunction with the capability of paying his entrance-fee and subscription, being sufficient to insure his right to employ the coveted letters, and to go on his way rejoicing. N.W.

[There can be no doubt that our correspondent's remarks are in great degree justified by facts, though they are somewhat too sweeping. Undoubtedly a large number of those who get themselves nominated and elected to learned societies have no other object but to improve their own position; and quite a large proportion of the members of some societies, even of highest repute, have scarcely any knowledge in the subject or subjects for whose advancement the society was founded. The former trouble is most mischievous when the wish to work a society involves the direct influence of the society itself, and not such indirect influence as is derivable from the society's name. For, those interested in advancing their own interests will always work more steadily and zealously, and in the end more successfully than those (more in number it may be hoped) who object to jobbing. A concrete object has more power than an abstract objection. It is noteworthy, too, how the introduction of these personal objects interrupts the good work of a learned society. For example some twelve years have passed since Col. Strange first tried to use the influence of the Royal Astronomical Society to advance his scheme for the endowment of research—a piece of mere jobbery as then presented, though before and since, on abstract principles the endowment of research has been supported by honest but simple-minded men: now I think I am within the mark in saying that in the last ten years not ten papers published by that society have been noticed outside the society's rooms. Nearly all the good work which the members of the society have had to do they have brought otherwise before the public than in the old-fashioned and excellent way which was in vogue before that unfortunate business began. The misuse of the influence of the grand old Royal Society is an older matter, as De Morgan long since told the world,—though this evil has I believe increased of late years. I have very little knowledge in that direction, however, my experience in the Royal Astronomical Society, a dozen years ago, making me determine never to become a candidate, or allow myself to be nominated for election, in any society whatsoever. I made an exception recently in the case of that "infant Hercules" as Dr. Huggins has called it the Liverpool Astronomical Society, which has done me the honour to elect me an associate, in company with my esteemed friend that excellent astronomer Captain W. Noble, and the zealous and skilful M. Terby, who has done so much to extend our knowledge of the planet Mars. But except in this case I have not (of my own free will) consented to be nominated for any society since the time when, in 1866, Dr. Huggins invited me to become a Fellow of the Royal Astronomical Society.* The reasons I have had are closely akin to those suggested by my friend, the writer of the above letter. Undoubtedly the matter to which he has directed attention is one of somewhat serious import. —Richard A. Proctor.

* In strict accuracy I may mention that I have been elected to other societies, as to several in America; also, somewhat to my surprise (seeing that I had already declined an invitation to be nominated), to the St. George's Chess Club; but in the last-named case I considered the approach of the International Tournament (a rather costly matter, I suppose) had something to do with the unexpected compliment; and therefore, on election, I cheerfully paid entrance-fee and a year's subscriptions, and (after a few months' interval to save appearances) withdrew, without as yet knowing exactly where the rooms of the club may be, except that they are somewhere in Albemarle-street.

EXTRAORDINARILY LOW BAROMETER.

[1111]—I possess one of the old-fashioned "clock-face" barometers, and on Saturday evening last, January 26, it performed a feat which I think is worthy of record and may, perhaps, interest some of your meteorological readers.

The face is, of course, marked from 28 in. (stormy), near the bottom on the left hand side, round the top through 29 in. (rain), 30 in. (fair), and so on down to 31 in. (very dry), near the bottom on the right hand side; but at the extreme bottom of the face, between the figures 28 and 31, there is a blank space, entirely unmarked. Well, all day on Saturday, the finger dropped rapidly down the left-hand side (the falling side) until, about 3 o'clock in the afternoon it had passed below the lowest figure (28 in.), and continued its career along the blank space towards the extreme bottom of the face, which point it passed about five o'clock, and still continued its course towards the right, until about ten o'clock, p.m., when it had nearly traversed the whole of the blank space, finally stopping at a point very near to the figure 31 in. (Very Dry). Here it stood for about a couple of hours, and then began slowly to retrace its "steps." By calculating the blank space according to the markings on the other parts of the face, I found that the extreme point reached by the finger would be about 27·55 in., indicating a terrible fall of the mercury.

I never in my life knew my barometer to act in such a manner before, and I might have thought there was something wrong with it if a friend and neighbour had not informed me that his barometer—one of similar description—performed exactly the same extraordinary feat.

The weather prevailing at the time was certainly extraordinary for the time of the year, for during the latter part of the afternoon there was a strong gale blowing, accompanied by heavy rain, and between 5.30 and 6 o'clock there were several very vivid flashes of lightning and moderately-loud peals of thunder, soon after which the wind became comparatively calm for an hour or two, and then rose again to a terrible gale, which continued all night, with rain, hail, and snow. On looking at the barometer next morning I found the finger had worked its way off the blank space again just on to the marked part, registering a fraction above 28 inches, and still slowly rising, the gale continuing. Excelsior.

AFTER-GLOW IN AMERICA.

[1112]—In reply to the request in a note to the article on the extraordinary sunsets in Knowledge of December 7th, which has only just reached me, I beg to inform you that on three successive evenings towards the close of November—I forget the exact dates—the after-glow at this place was very remarkable. I did not notice anything extraordinary at the time of sunset, which was a little after half-past four, but from about half-past five to quarter past six the whole western sky was lit up by a very vivid crimson light, rising very nearly to the zenith.

I described it in my home letters, but was not aware until English papers reached us that the same phenomenon had attracted notice over the greater part of the world.

I have observed no discolouration of the sun either at sunrise or sunset, and I believe no such effect has been observed in these parts.

On the morning of Dec. 18 I happened to be up at quarter-past six. Looking out of an east window I saw all the effects of sunrise over the south-eastern horizon. The colour was amber shading into orange, and the clouds were tipped with an orange-red. At a few minutes before seven I left my house, and saw the spires of the churches and the roofs of the higher houses gilded so strongly with sunlight that I fancied my watch must have deceived me and turned round to the eastward several times to see if the sun had actually risen.

From seven to half-past seven, or a little later, I was in a building. Coming out I looked to the east again, and saw the ordinary effects of a rather dull sunrise. The sun actually rose a few minutes later.

Last night again (26th) there was a remarkable after-glow, lasting from about quarter-past five to near six. It was at its brightest at about half-past five, and was of an orange-red colour, different to the crimson in November.

Halifax, Nova Scotia, *Dec.* 27. Chas. S. Akers, Col. R.E.

THE HEIGHTS ABOVE—AND THE DEPTHS BELOW.

[1113]—A remarkable illustration of human degradation reaches me from the other side of St. George's Channel. An Irish gentleman of station and fortune recently undertook, in concert with some of his English brethren, a series of observations of variable stars. He has, perforce, been compelled to relinquish his share of the task for the simple, but sufficient, reason that he dares not

cross his own grounds at night to proceed to his observatory, for fear of being murdered. This gentleman—whose name, for obvious reasons, I suppress—is resident on his own estate, and actually offered all his tenants leases in perpetuity three years before the Land Act was even heard of. Hence, it is the mere fact of his being a landlord at all which imperils his life. During all the ghastly horrors of the French Revolution, when the guillotine was perennially sodden with the life-blood of some of the best and wisest Frenchmen, Lalande was suffered to pursue his astronomical studies in peace; and, when the death of Robespierre enabled innocent men and women to breathe freely again, "thanked his stars" for his escape. It seems to have been reserved for the pitiful curs who fire through windows at night at defenceless women and children; who maim helpless cattle; who slink behind stone fences to shoot their unsuspecting victims; but who run like hares at the mere sight of a policeman; it seems, I say, to have been reserved for vermin like this to lie in wait for the life of a man going forth to study the wonders and beauties of those heavens, whose very canopy they pollute by crawling under it. Anti Murder League.

SOLUTION OF CRIBBAGE PROBLEM.

[1114]—Dealer: Two sixes and two sevens. Opponent: The same. Crib: Three fives and Knave of Clubs. Turn-up Card: Five of Clubs.

The Play.				Dealer's Score.
Opponent ... 7	Dealer ... 7	pair		2
„ ... 7	„ ... 7	and go		13
„ ... 6	„ ... 6	pair.....		2
„ ... 6	„ ... 6	and last card...		13
		Play	30	
		Hand.....	16	
		Crib	29	
		Answer	75	

H. H. H.

MIGRATION OF BIRDS.

[1115]—Mr. Grant Allen's contribution to a "partial elucidation" of the so-called migratory instinct of birds, Knowledge, Jan. 4, is interesting, but "the modus operandi of migration" is surely connected with the instinct of locality in general. Savages possess the latter well developed, and some among ourselves have personal evidence of the presence of its germ. The writer, for instance, commonly knows in what direction he is going, when travelling in a railway carriage or on board a steamer, by a sort of half conscious intuition, but occasionally feels a sensation of being carried in a direction opposite to the real, so that if journeying west the illusion that the north is on his left is not to be shaken off. This illusive sensation is commonly first felt by him when his back is turned towards the direction in which he is being carried, but once formed, no effort and no change of position has the slightest effect upon it, and it is to him unaccountable unless a reminiscence or survival of a far more perfect sense of local direction possessed by remote ancestors. Do certain animals, the carrier pigeon, for instance, possess a sensation of locality similar to this in kind, but which has the infallibility of the mariner's compass, and may conceivably be connected with the magnetic current? He has been led to suppose that the *instinct of locality* may be at bottom a sense of direction, by the observation of an old Australian squatter, that a dog carried away from home by train was noticed by him never to lose sense of direction, but when taken on to the platform at several stations, to pull a person leading it either straight back along the line or at a considerable angle from it, but always directly towards its old home.

J. C. Murray Aynsley.

LETTERS RECEIVED (SUB-EDITOR).

J. E.—E. R. M.—J. Sinclair.—Arthur Stanley. The notice appeared as sent by the person chiefly interested; why not blow *him* up?—J. W. See Knowledge, page 58.—Alphard. *No such comet expected.*—J. R. Ferree. Your paper, "strictly for publication," cannot be published here, nor can reply be sent either by mail, as you wish, or by post-card, which you deprecate. We cannot however keep from our readers the pleasing fact you have established by mathematical demonstration, that while every known cause = 1, the ultimate first cause = 2·718281828 ..... *Now* we understand what had so long seemed infinitely mysterious.—W. Cordwill. The Editor has been prevented by illness from carrying out the further observations referred to.

Our Whist Column.

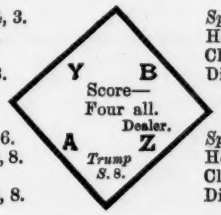
By "Five of Clubs."

THE following game is from the *Westminster Papers*. It shows how a game which seems lost, may be saved by care to the last in placing the leads:—

The Hands.

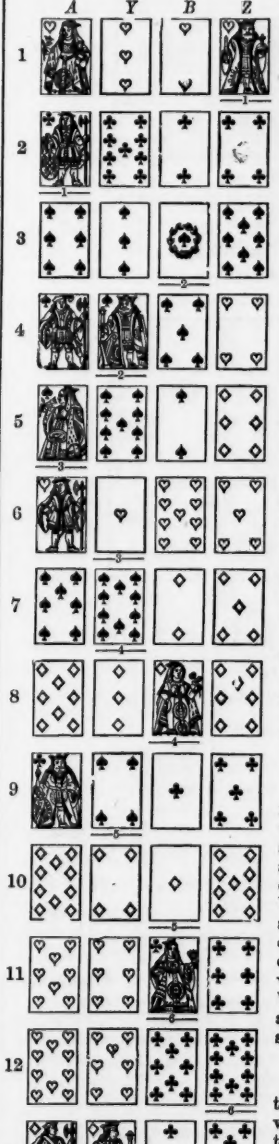
Y.
Spades—K, 10, 9, 4, 3.
Hearts—A, 7, 6, 3.
Clubs—9.
Diamonds—K, 4, 3.

B.
Spades—A, 5, 2.
Hearts—9, 2.
Clubs—A, Q, 8, 3, 2.
Diamonds—A, Q, 2.



A.
Spades—Q, Kn, 7, 6.
Hearts—Q, Kn, 10, 8.
Clubs—K, Kn.
Diamonds—Kn, 10, 8.

Z.
Spades—8.
Hearts—K, 5, 4.
Clubs—10, 7, 6, 5, 4.
Diamonds—9, 7, 6, 5.



NOTES AND INFERENCES.

1. *A* has Knave, Ten, another, almost certain. *Y* passes, having length in the suit and five trumps.

2. *Z* leads lowest of his five-card suit. This was before the "penultimate" signal was invented. *Z* sees that *Y* has no more Clubs; *A-B* know that he can hold none unless it be the Ten.

3. *A* leads trumps, because the score being at four all it is important to prevent the enemy from ruffing freely, as seems threatened.

4. *B*, of course, returns the highest of two, so that

5. *A* now finds *Y* with two trumps left. He also finds he has played the adversaries' game.

6, 7, and 8. The play here is simple enough. *Y* draws *A*'s last trump, and leads what must be *B*'s suit. It is the only chance of getting in *Z*'s Clubs. The game at this point looks bad for *Y-Z*. The one bit of blue sky is the certainty that neither *B* nor *Z* can have a Heart. If *A* can get a lead after *Y*'s long trump has been forced, the game is lost.

9. The King falls, and *Y*'s hopes are strengthened.

10. He throws the lead again into *B*'s hand, and as

11. *Z* luckily holds the minor tenace in Clubs

12, 13. *Z* makes the last two tricks and *Y-Z* win.

Whist Endings, p. 62.—We have received several letters asking whether *A-B* (especially in the second ending) can possibly win all the tricks against any play—or only if *Y-Z* play in specified ways. We reply that these endings are, as in all such cases, precisely like chess problems. A line is in each case to be found by which *A-B* can win, no matter how *Y-Z* may play. We give next week the solutions and the names of the successful solvers.

Ambr. Perry.—You should certainly have passed the trick. It was clearly fatal to you to have to lead. True the odds were at least 20 to 1 that you lost anyway. But 1/21 is many million times 0.

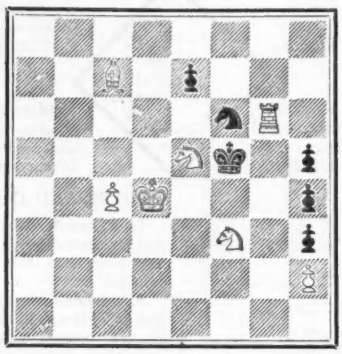
Our Chess Column.

By Mephisto.

PROBLEM No. 114.

By F. J. D.

Black.



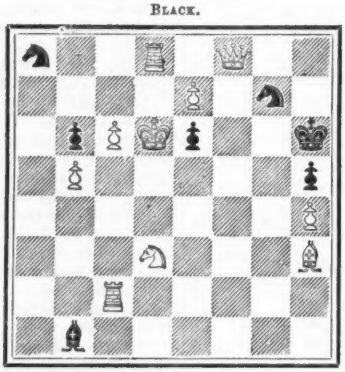
White.

White to play and mate in three moves.

SUI-MATE PROBLEM.

By H. W. Sherrard.

Black.



White.

White to play and sui-mate in six moves.

Solution.

1. Q to R8 (ch)	1. K to Kt3
2. Kt to K5 (ch)	2. K to B3
3. R to B2 (ch)	3. B to B4
4. R to Q7	4. Kt to B2
5. P to K8 (Kt) (ch)	5. Kt takes Kt (ch)
6. Q takes Kt Mated.	6. Kt takes Q (ch)

SOLUTIONS.

Problem by E. N. Frankenstein, p. 62.

1. B to Kt2	P to Kt4		
2. Kt to Kt3	P to Kt3, or		P takes Kt
3. Q to B7	Any	P to B4	Any
4. Q or Kt mates		Q or B mates	

(*a*)

2. Kt to Kt3
3. B or Q takes B (ch)
4. Q or Kt mates

1. R to K2
2. B moves
3. R moves

Problem by the Rev. H. Bolton, p. 62.

1. Q takes R	B to Kt3	5. K to R2	B to Kt7
2. Kt to Kt4	R to B2	6. B to B6	B moves
3. Q tks Q (ch)	R takes Q	7. B tks R, mate	
4. Kt to R6	B to K5 (ch)		

Sui-mate Problem, by By W. A. Shinkmann, p. 62.

Position.—Black.—Q, QR5; K, KB5. White.—Q, QB5; K, KR4; R, K2; B, KKt4; P, KKt2.

The few pieces employed, together with the unrestricted liberty of movement of the Black Queen, render this problem one of the best of its kind. The principle is that the Queen is caught everywhere, as follows:—

1. B to R3	Q to R sq, K sq, B3, or 7	Or (*a*)	Q to R4, 6
2. Q to Q4 (ch)	Q to K5	Q to Kt4 (ch)	Q takes Q
3. Q to B6 (ch)	Q to B4	P to Kt3 (ch)	K to B6 (ch)
4. Q to Kt5 (ch) Mated	Q takes Q (ch)	B to Kt4 (ch) Mated	Q takes B (ch)
1. (*b*)	Q to R3, 7, Kt4, or 6	(*c*)	Q to R2, 8, Q2, or 8
2. Q to B4 (ch)	Q takes Q	Q to Q4 (ch)	Q takes Q
3. P (ch)	K (ch)	P (ch)	K (ch)
4. B (ch)	Q mates	B (ch)	Q mates

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1. LIFE OF WORLDS.
2. THE SUN.
3. THE MOON.
4. THE PLANETS.
5. COMETS.
6. THE STAR DEPTHS.

See Advt. Pages for full Syllabus.

The following arrangements are complete: the numbers in brackets referring to above list.

BRISTOL (Colston Hall), Feb. 19, 22, 26, 29; March 4, 7 (the full course).

CHELTENHAM (Assembly Rooms), Feb. 8, 12, 15 (2, 4, 6). At 3 o'clock, Feb. 12 (3, 5).

BATH (Assembly Rooms). Morning Lectures at 3 o'clock, Feb. 9, 13, 16 (3, 4, 6); Evening, Feb. 13 (5).

GLOUCESTER (Corn Exchange), Feb. 20, 21, 27, 28 (1, 2, 3, 4).

TAUNTON (Victoria Rooms), March 5, 6 (1, 2).

SURBITON, Feb. 18, 25, March 3.

BIRKENHEAD, March 10.

ALTRINCHAM, March 11 (5).

CHESTER, March 12, 13 (1, 2).

HAVERSTOCK-HILL, March 14 (2).

REIGATE, March 19 (2).

HITCHIN, March 20 (5).

UXBRIDGE, March 21 (1).

LONDON (Brixton Hall) March 28, April 1, 4 (1, 2, 3).

" (Memorial Hall), March 24, 27, 31, April 3 (1, 2, 3, 4).

Note.—*All communications respecting Lectures should be addressed to Mr. John Stuart, Royal Concert Hall, St. Leonards.*

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SPECIAL NOTICES.

Volume IV., comprising the numbers published from July to December, 1883, is now ready, price 7s. 6d.; including parcels postage, 8s.

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